

# PATENT ABSTRACTS OF JAPAN

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(21)Application number : 04-220881

(71)Applicant : FUKUSHIMA NIPPON DENKI KK

(22)Date of filing : 28.07.1992

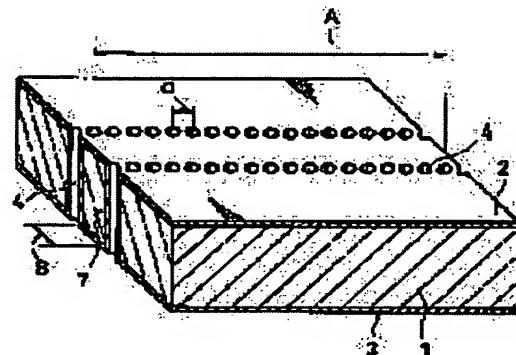
(72)Inventor : FURUYAMA SHIGEKI

## (54) WAVEGUIDE LINE

### (57)Abstract:

**PURPOSE:** To facilitate the processing and to improve the productivity by providing two lines of throughholes used to connect conductor layers, selecting an interval of the throughholes of each line smaller than an interval equivalent to a cut-off wavelength and selecting the interval of the two lines for the through holes to be a prescribed width of the waveguide.

**CONSTITUTION:** Two lines of plural throughholes 4, 4,... are provided for a dielectric base 1 including conductor layers 2, 3. An interval (a) of the throughholes of each line is selected to be an interval smaller than a cut-off wavelength of a relevant electromagnetic wave. Furthermore, an interval B of the lines of the throughholes 4 is selected in relation to a frequency of an electromagnetic wave. Thus, upper lower layers 2, 3 are connected by the lines of the throughholes 4 arranged at the smaller interval than the cut-off wavelength and a wall face of a square waveguide part 7 is formed approximately to form the waveguide line. In the Figure, a caption A indicates part of the waveguide line in the lengthwise direction. Thus, the electromagnetic having a prescribed frequency is surely propagated in a prescribed direction while being guided through the throughholes 4,4,... formed in the two lines in the base 1.



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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The waveguide track characterized by setting spacing of the train of the flow hole of these two trains as predetermined waveguide width of face while making spacing of 2 \*\*\*\*\* and the flow hole of each of this train into spacing smaller than cutoff wave length for the flow hole which consists of the plurality which connects said conductor layer to the dielectric substrate which has a conductor layer more than a bilayer.

[Claim 2] The waveguide track characterized by having set spacing of the train of the through hole of these two trains as predetermined waveguide width of face, and filling up said each through tube with a conductive member while making spacing of 2 \*\*\*\*\* and the through tube of each of this train into spacing smaller than cutoff wave length for the through tube which consists of the plurality which connects said conductor layer to the dielectric substrate which has a conductor layer more than a bilayer.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]**

[0001]

[Industrial Application] This invention relates to the waveguide track for a microwave band or millimeter wave bands which starts a waveguide track, especially is constituted in a dielectric substrate.

[0002]

[Description of the Prior Art] About the propagation circuit which sends an electromagnetic wave along with a substrate, some attempts, such as the strip line and a surface waveguide, are made and put in practical use conventionally.

[0003]

[Problem(s) to be Solved by the Invention] However, if it was in this conventional example, neither was necessarily enough about the unification with a substrate, after forming the propagation circuit for electromagnetic waves independently for this reason, there was troublesomeness of connecting with a predetermined substrate anew, and there was un-arranging [ that productivity was bad ].

[0004]

[Objects of the Invention] This invention sets it as the purpose to offer the waveguide track which planned the productivity drive while it improves un-arranging [ which this conventional example has ] and attains the unification with a dielectric substrate especially.

[0005]

[Means for Solving the Problem] While making spacing of 2 \*\*\*\*\* and the flow hole of each of this train into spacing smaller than cutoff wave length for the flow hole which consists of the plurality which connects said conductor layer with this invention to the dielectric substrate which has a conductor layer more than a bilayer, the configuration of setting spacing of the train of the flow hole of these two trains as predetermined waveguide width of face is taken. It is going to attain the purpose mentioned above by this.

[0006]

[Function] The electromagnetic wave of predetermined frequency is guided in the flow hole formed over two trains, and the inside of a dielectric substrate is certainly spread in the predetermined direction.

[0007]

[Example] Hereafter, one example of this invention is explained based on drawing 1 . In this drawing 1 , a sign 1 shows a dielectric substrate. Both sides of this dielectric substrate 1 are respectively equipped with conductor layers 2 and 3 in the shape of a field all over the. The flow holes 4 and 4 and .... which pierce through the conductor layers 2 and 3 concerned and the dielectric substrate 1 to said dielectric substrate 1 containing conductor layers 2 and 3, and change from plurality to it are prepared over two trains. Processing formation of the flow hole 4 of each of this train is carried out with the gestalt which flows through between the conductor layers 2 and 3 mentioned above. The spacing a of the flow hole 4 of each of this train is set as spacing smaller than the wavelength (cutoff wave length) of the electromagnetic wave concerned. Furthermore, the spacing B of the train which consists of a flow hole 4 of these plurality is specified with the frequency of an electromagnetic wave.

[0008] Thus, flow connection of the vertical conductor layers 2 and 3 is carried out by the train of

the flow hole 4 put in order at small spacing, the wall surface of the rectangular waveguide part 7 is formed in approximation by this of it, and the waveguide track is constituted from cutoff wave length. Notation A shows a part of die-length direction of a waveguide track. Thereby, the electromagnetic wave of predetermined frequency is guided at the flow holes 4 and 4 and .... which were formed over two trains, and the inside of the dielectric substrate 1 is certainly spread in the predetermined direction.

[0009] A through tube is formed first and you may make it fill up each through tube with a conductive member after that about the flow hole 4 here.

[0010] Thus, since a waveguide track can be formed free towards the part of the arbitration in the dielectric substrate 1 according to this example, processing becomes easy. The need of newly equipping with other members on a substrate since a waveguide track can be set up by carrying out predetermined hole processing to the dielectric substrate 1 is completely lost. The outstanding waveguide track which a configuration becomes very easy in this point, and is not in the former that the miniaturization of the whole equipment can also be attained can be acquired.

[0011]

[Effect of the Invention] Since this invention is constituted as mentioned above and functions, and a waveguide can be set up free towards the part of the arbitration in a dielectric substrate according to this, processing becomes easy. The need of newly equipping with other members on a substrate since a waveguide track can be set up only by carrying out two or more predetermined hole processings to a dielectric substrate is completely lost. The outstanding waveguide track which a configuration becomes very easy in this point, and is not in the former that the miniaturization of the whole equipment can also be attained as compared with the conventional thing can be offered.

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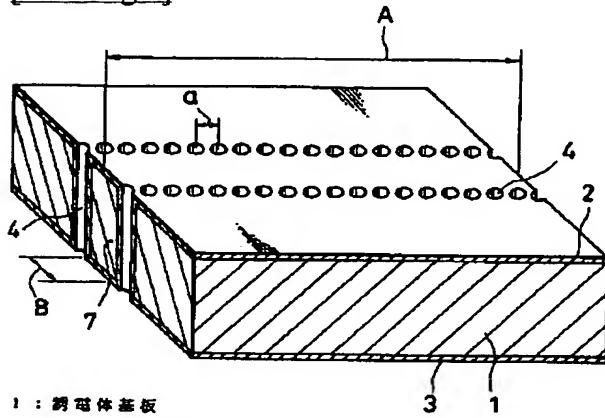
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DRAWINGS

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## [Drawing 1]



1 : 誘電体基板  
2, 8 : 导体層  
4 : 导通穴  
7 : 导波管部分  
A : 导波管線路長さ方向の一部  
a : 导通穴間隔  
B : 列の間隔

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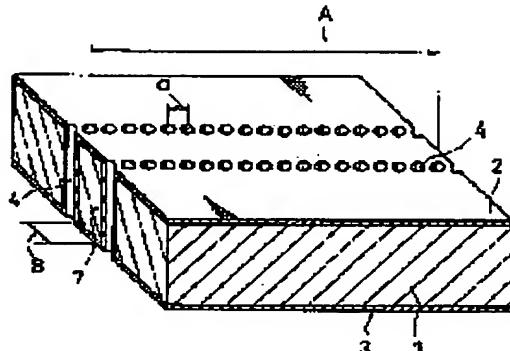
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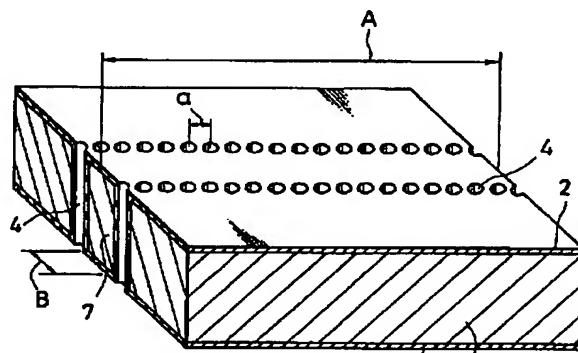
(74) 代理人 弁理士 高橋 勇

(54) 【発明の名称】導波管線路

(57) 【要約】

【目的】 誘電体基板との一体化を図ると共に、生産性向上を図った導波管線路を提供すること。

【構成】 二層以上の導体層2, 3を有する誘電体基板1に、導体層2, 3を結ぶ複数個から成る導通穴4を二列設け、この各列の導通穴4の間隔を遮断波長より小さい間隔とすると共に、この二列の導通穴4の列の間隔を所定の導波管幅に設定したこと。



1 : 誘電体基板

2, 3 : 导体層

4 : 导通穴

7 : 导波管部分

A : 导波管線路長さ方向の一部

a : 导通穴間隔

B : 列の間隔

## 【特許請求の範囲】

【請求項1】二層以上の導体層を有する誘電体基板に、前記導体層を結ぶ複数個から成る導通穴を二列設け、この各列の導通穴の間隔を遮断波長より小さい間隔とすると共に、この二列の導通穴の列の間隔を所定の導波管幅に設定したことを特徴とする導波管線路。

【請求項2】二層以上の導体層を有する誘電体基板に、前記導体層を結ぶ複数個から成る貫通孔を二列設け、この各列の貫通孔の間隔を遮断波長より小さい間隔とすると共に、この二列の貫通穴の列の間隔を所定の導波管幅に設定し、前記各貫通孔に導電性部材を充填したことを特徴とする導波管線路。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明は、導波管線路に係り、特に誘電体基板内に構成されるマイクロ波帯或いはミリ波帯用の導波管線路に関する。

## 【0002】

【従来の技術】基板に沿って電磁波を送る伝送回路については、従来よりストリップ線路や表面波線路等いくつかの試みがなされ実用化されている。

## 【0003】

【発明が解決しようとする課題】しかしながら、かかる従来例にあっては、いづれも、基板との一体化については必ずしも充分なものではなく、このため、電磁波用の伝送回路を別に形成したのち、改めて所定の基板に連結するという煩わしさがあり、生産性が悪いという不都合があった。

## 【0004】

【発明の目的】本発明は、かかる従来例の有する不都合を改善し、とくに、誘電体基板との一体化を図ると共に、生産性向上を図った導波管線路を提供することを、その目的とする。

## 【0005】

【課題を解決するための手段】本発明では、二層以上の導体層を有する誘電体基板に、前記導体層を結ぶ複数個から成る導通穴を二列設け、この各列の導通穴の間隔を遮断波長より小さい間隔とすると共に、この二列の導通穴の列の間隔を所定の導波管幅に設定する、という構成を採っている。これによって前述した目的を達成しようとするものである。

## 【0006】

【作用】所定周波数の電磁波が、誘電体基板内を二列にわたって形成された導通穴に案内されて、所定の方向に確実に伝播される。

## 【0007】

【実施例】以下、本発明の一実施例を図1に基づいて説

明する。この図1において、符号1は誘電体基板を示す。この誘電体基板1の両面には、その全面に導体層2、3が各々面状に装着されている。導体層2、3を含む前記誘電体基板1には、当該導体層2、3および誘電体基板1を貫いて複数個から成る導通穴4、4、……が二列にわたって設けられている。この各列の導通穴4は、前述した導体層2、3の相互間を導通する形態をもって加工形成されている。この各列の導通穴4の間隔aは、当該電磁波の波長（遮断波長）よりも小さい間隔に設定されている。更に、これら複数の導通穴4からなる列の間隔Bは、電磁波の周波数により特定されるようになっている。

【0008】このように、遮断波長より小さな間隔で並べられた導通穴4の列によって上下導体層2、3が導通連絡され、これにより方形導波管部分7の壁面が近似的に形成されて導波管線路が構成されている。記号Aは導波管線路の長さ方向の一部を示す。これにより、所定周波数の電磁波は、誘電体基板1内を二列にわたって形成された導通穴4、4、……に案内されて所定の方向に確実に伝播されるようになっている。

【0009】ここで、導通穴4については、貫通孔をまず形成し、その後に各貫通孔に導電性部材を充填するようにしたものであってもよい。

【0010】このように本実施例によると、誘電体基板1内の任意の箇所に向けて自在に導波管線路を形成し得るので加工が容易となり、誘電体基板1に所定の孔加工をすることにより導波管線路を設定し得るので基板上に新たに他の部材を装着する必要が全く無くなり、かかる点においては構成がいたって簡単となり、装置全体の小型化も図り得るという従来にない優れた導波管線路を得ることができる。

## 【0011】

【発明の効果】本発明は、以上のように構成され機能するので、これによると、誘電体基板内の任意の箇所に向けて自在に導波管を設定し得るので加工が容易となり、誘電体基板に複数個の所定の孔加工をするだけで導波管線路を設定し得るので基板上に新たに他の部材を装着する必要が全く無くなり、かかる点においては構成がいたって簡単となり、従来のものに比較して装置全体の小型化も図り得るという従来にない優れた導波管線路を提供することができる。

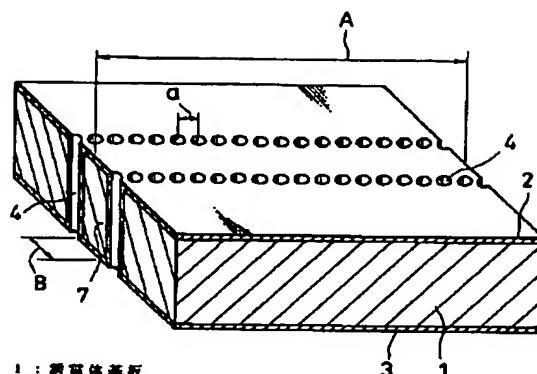
## 【図面の簡単な説明】

【図1】本発明の一実施例の一部を示す斜視図である。

## 【符号の説明】

- 1 誘電体基板
- 2, 3 導体層
- 4 導通穴

【図1】



- 1 : 誘電体基板
- 2, 3 : 等体層
- 4 : 導通穴
- 7 : 導波管部分
- A : 導波管線路長さ方向の一部
- a : 導通穴間隔
- B : 列の間隔